frequency transceiver circuitry **72** may be coupled to intermediate frequency antenna **400**A in device **10**A. Antenna **400**A may communicate wirelessly with a corresponding antenna such as antenna **400**B in case **10**B. Antennas **400**A and **400**B may communicate using near field communications (i.e., antennas **400**A and **400**B may be patch antennas or other antennas that are electromagnetically near field coupled, may be loop antennas that are inductively near field coupled, may be capacitor plate structures or other near field antenna structures that are capacitively near field coupled, etc.). Intermediate frequency transceiver circuitry **74** in case **10**B may be coupled to antenna **400**B.

[0035] During operation, device **10**A may use transceiver circuitry **72** and antenna **400**A to transmit and/or receive IF signals that are received and/or transmitted by antenna **400**B and transceiver circuitry **74** in case **10**B.

[0036] In case **10**B, intermediate frequency signal path **77** may convey IF signals between transceiver circuitry **74** and circuitry **75**. Circuitry **75** may be implemented on a semiconductor device (e.g., an integrated circuit such as a silicon die) or may be formed from one or more devices mounted on a printed circuit or other substrate. Circuitry **75** may include upconverter/downcoverter circuitry and transceiver circuitry coupled to path **77**, for converting IF signals from path **77** to radio-frequency signals for transmission over an antenna array formed from antennas **40-1**, **40-2**, . . . **40**-N (i.e., antenna array **40**) and for receiving radio-frequency signals from antenna array **40** and converting received radio-frequency signals from the antenna array to intermediate frequency signals for path **77**. Circuitry **75** may include circuitry such as phased array transceiver circuitry **34-2** of FIG. **3** for implementing beam steering. The antennas of array **40** of FIG. **6** may communicate wirelessly with one or more antennas in external equipment **10**C over wireless link **26**.

[0037] Any suitable communications bands may be supported over link **26**. As an example, circuitry **75**, the antennas of array **40**, wireless link **26**, and the transceiver circuitry in equipment **10** may be used to support wireless communications in extremely high frequency (EHF) bands at 60 GHz (or at 24 GHz or other millimeter wave communications bands, frequencies above 60 GHz, etc.). Communications may also be supported at IEEE 802.11 wireless local area network bands such as the bands at 2.4 GHz, 5 GHz, bands at frequencies below 100 MHz such as NFC bands, etc.

[0038] If desired, power may be conveyed wireles sly from equipment **10**C. An illustrative configuration for charging electronic device **10**A wirelessly using equipment **10**C and case **10**B is shown in FIG. **7**. In the example of FIG. **7**, equipment **10**C has power transmission circuitry **34**PT that is coupled to an array of one or more antennas **40**P in equipment **10**C. Antennas **40**P may, as an example, be antennas that operate at 2.4 GHz, 5 GHz, other microwave frequencies, or other suitable frequencies (as examples). Antennas **40**P may be supported by one or more printed circuits and/or may be formed as part of one or more integrated circuits. For example, antennas **40**P may be mounted on a printed circuit substrate such as illustrative printed circuit **40**PC. Antennas **40**P may convey wireless power to a corresponding set of antennas **40**P' in case **10**B. Antennas **40**P' may include one or more antennas (e.g., an array of antennas) and may be implemented on one one or more semiconductor dies and/or mounted on one or more printed circuit board substrates (see, e.g., substrate **40**PC').

[0039] Circuitry **34**PT of equipment **10**C may transmit power wireles sly to case **10**B over wireless path **26**. Power for circuitry **34**PT may be supplied using a power source such as power source **60**. Power source **60** may provide alternating current (AC) power from a wall outlet or may be based on a battery. Transmitter circuitry **62** (e.g., a transmitter with circuitry for controlling a phased antenna array such as antenna array **40**P) may be used to wirelessly transmit power that has been received from power source **60** to case **10**B over wireless path **26** with antenna array **40**P, as described in connection with circuitry **62** of FIG. **5**.

[0040] Case **10**B may include circuitry such as circuitry **92** for receiving radio-frequency power signals from antenna array **40**P' and for converting this circuitry to DC power (see, e.g., circuitry **34**PT' of FIG. **5**). DC power from circuitry **92** may be provided to battery **52**B to charge battery **52**B and may be conveyed to device **10**A using a wired path (e.g., via path **80**, connector **204** of case **10**B and via connector **130** and path **88** of device **10**A). Alternatively, or in combination with transferring power from case **10**B to device **10**A using a wired path, power can be transferred wireles sly. For example, circuitry **92** of case **10**B can include transmitter circuitry such as circuitry **62** of FIG. **3** that is coupled to an antenna such as antenna **82** that is near-field coupled to antenna **84** in device **10**A. Circuitry **92** can use antenna **82** to convey power wirelessly to antenna **84** in device **10**A (e.g., at 2.4 GHz, at 5 GHz, at other microwave frequencies, or at other frequencies). Antenna **84** may be coupled to circuitry **86** (e.g., power conversion circuitry such as circuitry **64** of FIG. **5**). Circuitry **86** may convert received radio-frequency power signals from antenna structure **84** to DC power on path **90**. Antennas such as antennas **82** and **84** may be patch antennas or other antennas that are electromagnetically near field coupled, may be loop antennas that are inductively near field coupled, may be capacitor plate structures or other structures that are capacitively near field coupled, or may be other suitable wireless power transfer structures.

[0041] If desired, case **10**B may include both wireless communications antennas such as antenna array **40** of FIG. **6** and wireless charging antennas such as antenna array **40**P' of FIG. **7**. Shared antenna structures or separate sets of antennas may be used in forming the wireless communications antennas and wireless charging antennas in configurations in which case **10**B contains both wireless communications and wireless charging antennas.

[0042] The foregoing is merely illustrative and various modifications can be made by those skilled in the art without departing from the scope and spirit of the described embodiments. The foregoing embodiments may be implemented individually or in any combination.

What is claimed is:

1. A removable electronic device case that is configured to mate with an electronic device and that supports wireless communications with external equipment, comprising:

a body configured to mate with the electronic device;

radio-frequency transceiver circuitry in the body; and

an array of antennas with which the radio-frequency transceiver circuitry wireles sly communicates with the external equipment.

2. The removable electronic device case defined in claim **1** wherein the radio-frequency transceiver circuitry includes